From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
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ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 09 August 1999 (09.08.99)	
International application No. PCT/US98/18087	**Applicant's or agent's file reference** RCA 88785
International filing date (day/month/year) 01 September 1998 (01.09.98)	**Priority date** (day/month/year) 12 December 1997 (12.12.97)
Applicant RAMASWAMY, Kumar et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

29 June 1999 (29.06.99)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
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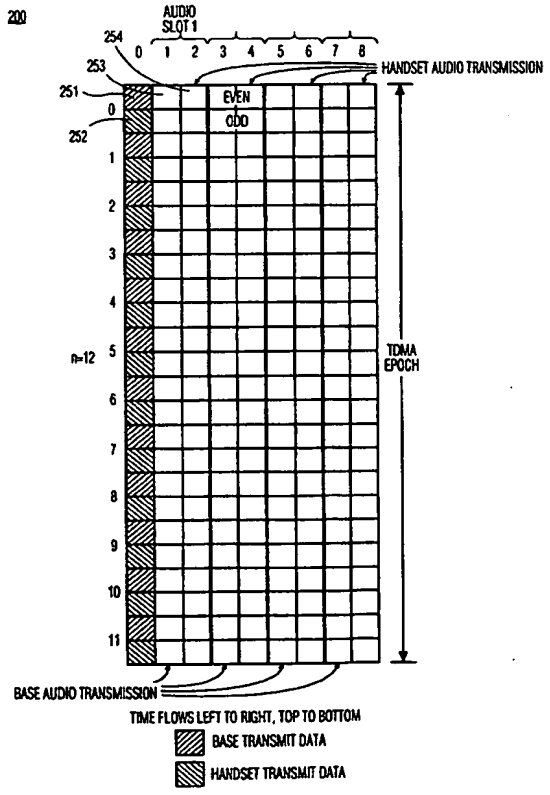
(54) Title: RETRIEVING STORED DATA FROM A BASE UNIT OF A MULTI-LINE WIRELESS PHONE SYSTEM

(57) Abstract

A wireless telephone system comprises a base unit and a plurality of wireless handsets. The base unit has a base transceiver and a memory for storing stored information. Each handset has a handset transceiver for establishing a data link and an audio link with the base unit via the base transceiver, wherein the data link is for transmitting signaling information and the audio link is for transmitting voice data for a real–time telephone call. The handset requests from the base unit certain stored information. In response, the base unit retrieves the requested stored information from the memory and transmits the stored information to the handset via the audio link.



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RETRIEVING STORED DATA FROM A BASE UNIT OF A MULTI-LINE WIRELESS PHONE SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to multi-line wireless telephone systems and, in particular, to data transmission in a time-division multiplexed (TDM) wireless telephone system.

Description of the Related Art

The use of telephones and telephone systems, including wireless telephone systems, is widespread. In wireless telephone systems, a cordless or wireless telephone handset unit communicates via either analog or digital radio signals with a base unit, which is typically connected via a standard telephone line to an external telephone network. In this manner, a user may employ the wireless handset to engage in a telephone call with another user through the base unit and the telephone network.

Multi-line wireless telephone systems are in use in various situations, such as businesses with many telephone users. Such systems employ a handset that communicates with up to N handsets simultaneously, typically with digital communications schemes, such as a spread-spectrum, time division multiple access (TDMA). In a TDMA system, a single RF channel is used, and each handset transmits and receives audio data packets as well as non-audio data packets during dedicated time slices or slots within an overall TDMA cycle or epoch. It is desirable to provide various features, such as private

branch exchange (PBX) features and capabilities, in a multi-line wireless telephone system. It is also desirable to transmit or retrieve non-audio data over the RF channel. For example, a handset may wish to retrieve certain stored data, such as voice mail or caller ID data, which is stored in the base unit or in a device coupled to the base unit.

SUMMARY

A wireless telephone system comprises a base unit and a plurality of wireless handsets. The base unit has a base transceiver and a memory for storing stored information. Each handset has a handset transceiver for establishing a data link and an audio link with the base unit via the base transceiver, wherein the data link is for transmitting signaling information and the audio link is for transmitting voice data for a real-time telephone call. The handset requests from the base unit certain stored information. In response, the base unit retrieves the requested stored information from the memory and transmits the stored information to the handset via the audio link.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of TDMA multi-line wireless telephone system, in accordance with an embodiment of the present invention; and

Fig. 2 is a schematic representation of the TDMA slot structure used in the TDMA scheme of the system of Fig. 1, in accordance with an embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to Fig. 1, there is shown a block diagram of TDMA multi-line wireless telephone system 100, in accordance with an embodiment of the present invention. TDMA system 100 comprises a base unit 110, which has receiver and transmitter units 112 and 111, respectively, and is coupled to external telephone network 116 via telephone line(s) 115. Base unit 110 has a memory or storage device 118, such as a RAM or hard disk drive, for storing stored data. System 100 also comprises N wireless handsets 120_1, 120_2, . . . 120_N. Each has a transmitter and receiver unit (transceiver), such as transmitter 121 and receiver 122 of handset 120_1. At any given time, some number (or none) of the handsets are operating or off hook (i.e., in the process of conducting a telephone call). System 100 thus provides a wireless network between the base station 110 and each handset 120_i ($1 \leq i \leq N$). In one embodiment, system 100 comprises 4 handsets 120_1–120_4, all of which may be active simultaneously. In another embodiment, system 100 comprises a different number of handsets, e.g. N=12, of which up to 8 can be active or operational at a time.

In one embodiment, the present invention comprises a TDMA system for connecting multiple transceivers to a base station over a single RF channel. In particular, system 100 employs a digital TDMA scheme, as described in further detail below, which allows power to be efficiently used since each operating handset is "off" (i.e., not transmitting or receiving data, and thus not using as much battery power) during most portions of the TDMA epoch, and is only "on" during its own time slices or slots. In one embodiment, a handset

powers off by switching off power to at least its CPU and transceiver (receiver and transmitter) units, while leaving powered on only a clock and associated timer or watchdog circuitry sufficient to wake up the CPU at a predetermined slot time.

Referring now to Fig. 2, there is shown a schematic representation of the TDMA slot structure 200 used in the TDMA scheme 200 of the system of Fig. 1, in accordance with an embodiment of the present invention. System 100 employs a TDMA epoch having structure 250, which is illustrated assuming 12 total handsets 120_1–120_{12}, of which 8 can be active or operational at a time, e.g. handsets 120_1–120_8. TDMA epoch structure 250 comprises a number of rows and columns. Each row of TDMA structure 250 represents a 2ms field of digital data, and is either even or odd and grouped in a pair with an odd or even, respectively, row or field. TDMA epoch structure 250 is a 48ms epoch.

In normal mode of operation, each field comprises nine total packets: a (non-audio) data packet in the first column (either transmitted from the base or from a handset) and eight audio packets, grouped in 4 pairs of two. Each such pair of audio packets in a row includes one packet (time slot) of base audio transmission (to a given handset from base unit 110) and one packet of handset audio transmission (from the given handset to the base). Thus, within each epoch, there is allocated to each handset one pair of data packet slots and several pairs of audio packet slots. The data packet slots are used to establish a "data link" with each respective handset, and the audio packet slots are used to establish an "audio link" with each respective handset. The data links together constitute the system's data channel, while the audio links constitute the system's audio

channel. In other words, the first column of TDMA epoch structure 200 corresponds to the data channel (data links), and the remaining columns correspond to the audio channel (audio links).

The data link for a given handset is used to transmit, via data packets, non-audio data referred to generally herein as signaling information. Each data packet is a set of data transmitted either to a given handset from the base unit or vice-versa, during a discrete time slot during which time no other handsets receive or transmit data over the system's data channel. These data packets may contain various types of data, such as synchronization data or words with time stamp information transmitted to a handset in sleep mode, caller ID information, incoming call information, telephone number being dialed by the handset, and the like. The signaling information conveyed by the data link is used to setup calls, inform the handset of incoming calls, maintaining the communication links between the handsets and base, and the like.

Voice data, i.e. audio packets containing audio data for a real-time telephone conversation, is transmitted over the audio link for a given handset. The bandwidth for the audio link for a handset is much higher than the bandwidth for the data link. This is because, within each epoch, there is allocated to each handset one pair of data packet slots and several pairs of audio packet slots. For example, for N=12 total handsets 120_1–120_{12} with up to 8 off hook at a time, there are 12 audio packet pairs per handset per epoch, compared to 1 data packet pair per handset per epoch, for an audio channel (or link) bandwidth 12 times greater than the data channel (or link) bandwidth. The audio packets contain digitized (and possibly compressed) voice information.

Thus, for example, row pair 0 comprises an even row and odd row. In the even row, the base transmits data in the first time slot (slot 251), to one of the 12 handsets, e.g. handset 120_1. There is one row pair in epoch 250 for each handset, so that each handset can receive and transmit data to base unit 110 once per epoch. After the first data slot 251, assuming handset 120_1 is operational (off hook), an audio packet is transmitted to handset 120_1 in audio packet slot 253, then an audio packet is transmitted by handset 120_1 to base unit 110 in audio packet slot 254, and so on for 3 of the other handsets until the end of the field or row. In the odd row for row pair 0, data slot 252 is used to receive data transmitted from handset 120_1 to base unit 110, and audio packets are transmitted for the remaining 8 active handsets. In row pairs 1–11, the same sequence occurs, except the data packets are to and from different handsets than for row pair 0.

It is desirable for a handset user to be able to retrieve stored data which is stored in memory 118 of the base unit 110. This information is in addition to signaling data typically transmitted via the data link and voice data typically transmitted via the audio link. Stored data includes all stored/backed up information that is available in the base unit. This information may represent voice, data, or other service information. For example, the stored data may be a voice mail information, caller ID information, or other service information.

Such stored information is typically requested by a handset via its data link, since the request is itself a type of signaling information. Because the stored data is not audio data pertaining to a concurrent telephone call, it could be transmitted via the data link. However,

this may be impractical or undesirable because the bandwidth of the data link is lower than that of the audio link. Therefore, in the present information, when stored information is requested by a handset, the audio link is temporarily converted to a "stored data" link, voice data transmission is temporarily halted (muted or interrupted), and stored data is transferred to the handset during that handset's audio data slots. This allows the stored data to be transmitted at a much higher rate to the handset than if the lower-bandwidth data link were used.

In the present invention, first, a handset 120_i requests stored data from base unit 110. Base unit 110 then fetches the stored data from memory 118, and combines the stored data into the voice link for handset 120_i as digital information. Since handset 120_i has knowledge about its request, it knows what type of stored data to expect on its audio link, and thus knows which type of decoding or processing to use when the stored information is received.

For example, if a voice mail message is to be retrieved, handset 120_i transmits an appropriate request for the voice mail message to base unit 110 via its data link. Base unit 110 retrieves the stored voice mail data, which may be stored in compressed format for efficient use of memory 118. This compressed, digital information representing the requested voice mail message is then transmitted to handset 120_i via its audio link, instead of its data link. Handset 120_i then processes the stored data received via its audio link through its voice decompression engine. On the other hand, if caller ID information is retrieved, then the data coming over the audio link is appropriately processed and displayed on the handset's display.

The present invention, therefore, creates an asymmetrical link for information retrieval in a wireless system so that efficient use of the available bandwidth is possible.

In an alternative embodiment, the audio link is used to retrieve stored data only if it is not already in use. In this case, the data link is used by a handset to request retrieval of stored data. If the audio link is in use by the handset, then the data link is used to transmit the stored data to the handset. However, if the audio link is not in use, then the audio link is used instead as a stored data link to transmit the stored data at a higher rate.

In an alternative embodiment, the stored information retrieved by a handset is not actually stored in base unit 110, but is stored in a device external to base unit 110, such as an external PC or storage device, which is coupled by a suitable interface to base unit 110. In this case, the stored information is retrieved by the handset from the storage device, via base unit 110, and the storage device is considered to be the same as memory 118, whether located in base unit 110, directly accessible by base unit 110, or accessible by base unit 110 via some interface. For purposes of this application, therefore, any information stored either directly in base unit 110 or in a device functionally coupled thereto such that the base unit is able to provide the stored data upon request to a handset, is considered to be information stored in base unit 110, since from the point of view of a handset, the request is made of base unit 110 and the information provided by base unit 110 appears to be stored in base unit 110.

One skilled in the art will recognize that the wireless system described above according to the principles of the invention may be a

cellular system where base unit 110 represents a base station serving one of the cells in a cellular telephone network.

In an alternative embodiment, instead of a handset retrieving over the audio link data actually stored in memory 118, the handset may wish to retrieve data from a data source accessible to the base unit 110. For example, base unit 110 may receive via an external line a modem signal containing data. In this case, the handset may be coupled to a telephone data port of a computer, for example. The handset requests from base unit 110 to be connected to a data source or channel, such as that provided by the modem. Base unit 110 then transmits the data decoded from the modem, to the handset via the audio link.

It will be understood that various changes in the details, materials, and arrangements of the parts which have been described and illustrated above in order to explain the nature of this invention may be made by those skilled in the art without departing from the principle and scope of the invention as recited in the following claims.

CLAIMS

1. A wireless telephone system, comprising:

(a) a base unit having a base transceiver; and

(b) a plurality of wireless handsets, each handset comprising a handset transceiver for establishing a data link and an audio link with the base unit via the base transceiver, wherein the data link is for transmitting signaling information and the audio link is for transmitting voice data for a real-time telephone call, wherein the base unit, upon request from a handset for data from a data source, retrieves the requested data from the data source and transmits the retreived data to the handset via the audio link.

2. The system of claim 1, wherein the data link is a time-division multiple access (TDMA) data link and the audio link is a TDMA audio link each established in accordance with a TDMA epoch allocating exclusive data and audio packet time slots to each handset.

3. The system of claim 2, wherein:

the epoch has a plurality of transmit and receive data row pairs, one such row pair for each handset; and

each handset receives and transmits data packets via receive and transmit data packet slots only once during each epoch, during the transmit and receive data row pair for each said handset, and receives and transmits audio packets during a plurality of allocated audio time slots of the epoch for the handset.

4. The system of claim 3, wherein:

the plurality of handsets comprises 12 handsets, 8 of which may be communicating at a time;

the epoch comprises 12 data row pairs, one data row pair for each handset; and

the epoch comprises at least 12 allocated audio time slot pairs for each handset.

5. The system of claim 1, wherein the data source is a memory for storing data and the requested data is stored data stored in the memory.

6. The system of claim 5, wherein the base unit comprises the memory.

7. The system of claim 5, wherein the base unit is coupled to an external computer comprising the memory.

8. The system of claim 5, wherein the base unit transmits the stored information to the handset via the audio link only if the handset is not currently using the audio link to transmit telephone voice data.

9. The system of claim 5, wherein the stored information is one of stored caller ID information and stored compressed voice mail message data.

10. The system of claim 9, wherein the handset requesting the stored information processes the stored information upon receipt in accordance with the nature of the stored information.

11. In a wireless telephone system comprising a base unit having a base transceiver and a plurality of wireless handsets, each handset comprising a handset transceiver, a method comprising the steps of:

(a) establishing, with each handset via its handset transceiver, a data link and an audio link with the base unit via the base transceiver, wherein the data link is for transmitting signaling information and the audio link is for transmitting voice data for a real-time telephone call;

(b) requesting, with the handset, from the base unit data from a data source;

(c) retrieving, with the base unit, the requested data from the data source in response to the request; and

(d) transmitting the retrieved data from the base unit to the handset via the audio link.

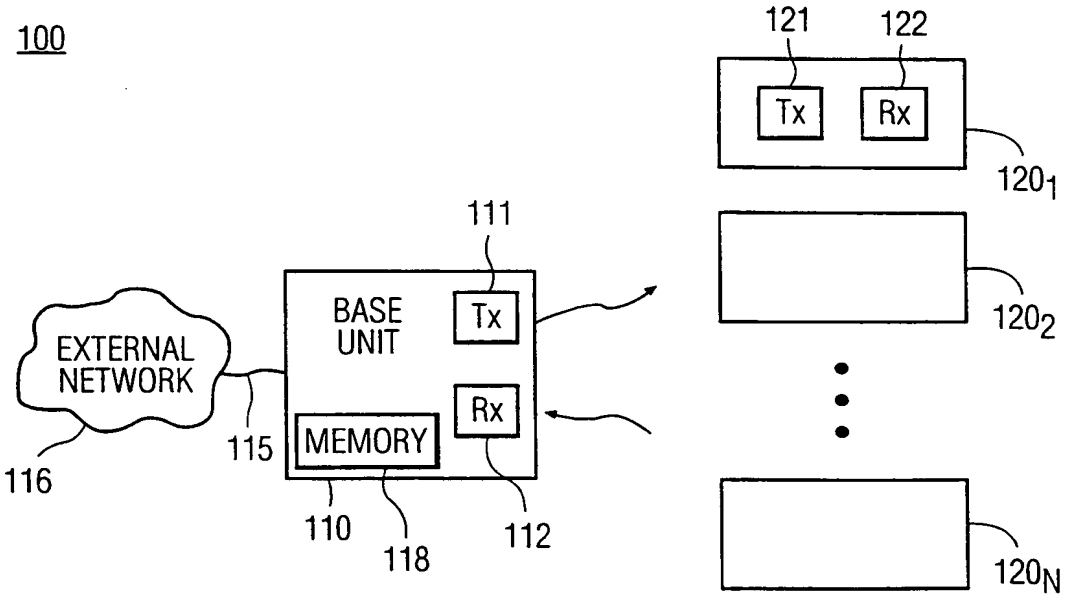
12. The method of claim 11, wherein the data source is a memory for storing data and the requested data is stored data stored in the memory.

13. A base unit for communicating with a plurality of wireless handsets, each handset comprising a handset transceiver, the base unit comprising:

(a) a base transceiver for establishing a data link and an audio link with each handset via the handset transceiver, wherein the data link is for transmitting signaling information and the audio link is for transmitting voice data for a telephone call; and

(b) a memory for storing stored information, wherein the base unit, upon request from the handset for stored information stored in the memory, retrieves the requested stored information from the memory and transmits the stored information to the handset via the audio link.

14. The base unit of claim 13, wherein the data source is a memory for storing data and the requested data is stored data stored in the memory.


100
121
122
Tx
Rx
120_1
111
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Tx
Rx
EXTERNAL NETWORK
MEMORY
115
116
110
118
112
120_2
120_N

FIG. 1

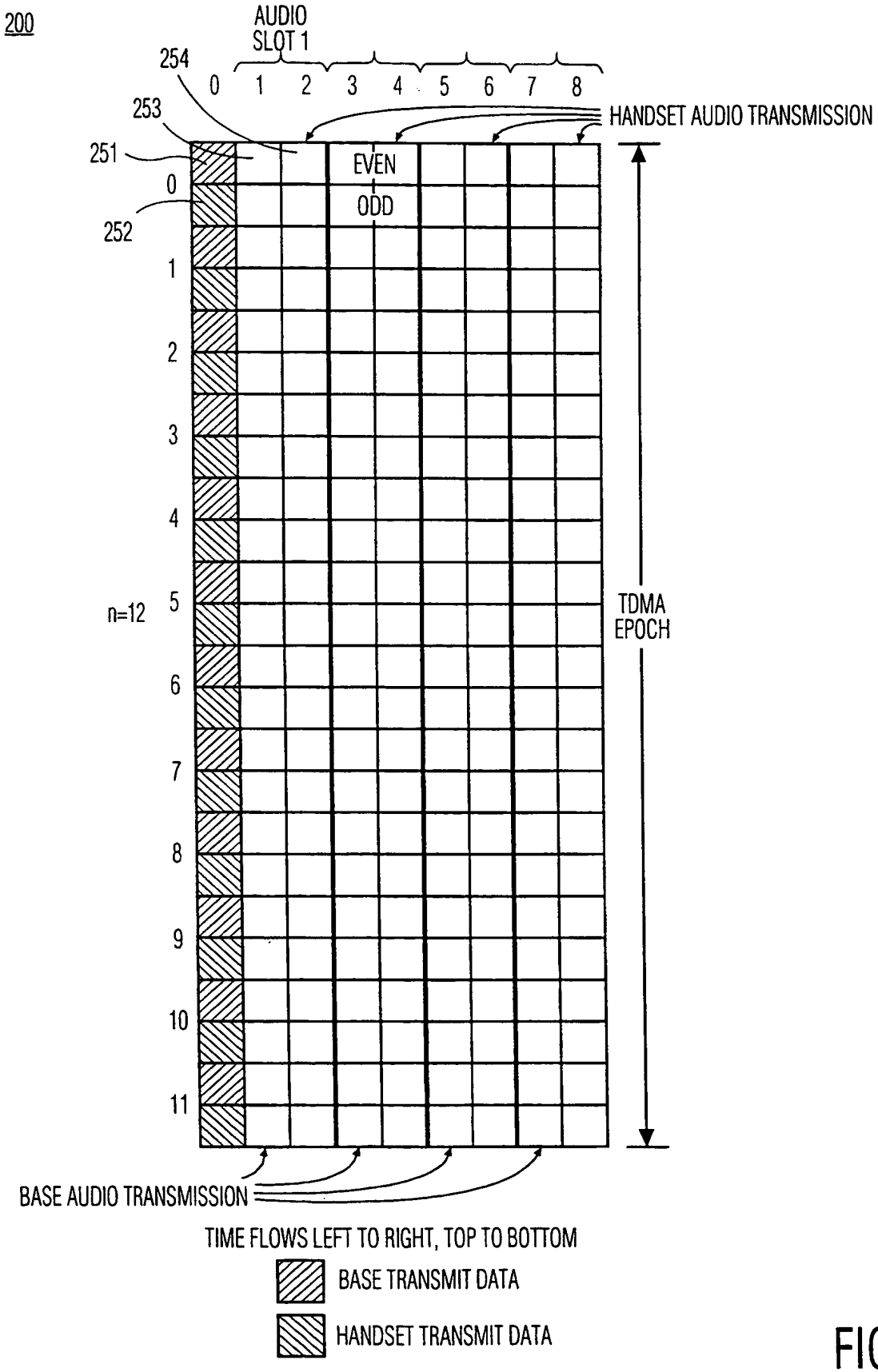
200
AUDIO SLOT 1
254
0 1 2 3 4 5 6 7 8
253
HANDSET AUDIO TRANSMISSION
251
EVEN
0
ODD
252
1
2
3
4
n=12 5
6
7
8
9
10
11
TDMA EPOCH
BASE AUDIO TRANSMISSION
TIME FLOWS LEFT TO RIGHT, TOP TO BOTTOM
BASE TRANSMIT DATA
HANDSET TRANSMIT DATA

FIG. 2

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

16

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
RCA 88785		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US98/18087	01/09/1998	12/12/1997
International Patent Classification (IPC) or national classification and IPC H04B7/26		
Applicant THOMSON CONSUMER ELECTRONICS, INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 12 sheets.

3. This report contains indications relating to the following items:

I	☒	Basis of the report
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
VI	☐	Certain documents cited
VII	☒	Certain defects in the international application
VIII	☐	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
29/06/1999	01. 03. 00
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Katruff, M Telephone No. +49 89 2399 2440

Form PCT/IPEA/409 (cover sheet) (January 1994)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
RCA 88785		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US 98/ 18087	01/09/1998	12/12/1997
Applicant		
THOMSON CONSUMER ELECTRONICS, INC. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. [ ] **Certain claims were found unsearchable** (see Box I).

2. [ ] **Unity of invention is lacking** (see Box II).

3. [ ] The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing
   - [ ] filed with the international application.
   - [ ] furnished by the applicant separately from the international application,
     - [ ] but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
   - [ ] Transcribed by this Authority

4. With regard to the **title,**
   - [X] the text is approved as submitted by the applicant
   - [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**
   - [X] the text is approved as submitted by the applicant
   - [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is:
   Figure No. 2
   - [X] as suggested by the applicant.
   - [ ] because the applicant failed to suggest a figure.
   - [ ] because this figure better characterizes the invention.
   - [ ] None of the figures.

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

TRIPOLI, J. et al.
THOMSON MULTIMEDIA LICENSING INC.
P.O. Box 5312
Princeton, New Jersey 08543
ETATS-UNIS D'AMERIQUE

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	6 . 00
Applicant's or agent's file reference RCA 88785	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US98/18087	01/09/1998	12/12/1997

Applicant
THOMSON CONSUMER ELECTRONICS, INC. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

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Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
RCA 88785		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US98/18087	01/09/1998	12/12/1997
International Patent Classification (IPC) or national classification and IPC H04B7/26		
Applicant THOMSON CONSUMER ELECTRONICS, INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 12 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
29/06/1999	06.
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Katruff, M Telephone No. +49 89 2399 2440

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US98/18087

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1,5	as originally filed	
2-4,6-9	with telefax of	19/01/2000

Claims, No.:

1-13	with telefax of	19/01/2000

Drawings, sheets:

1/2,2/2	as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

see separate sheet

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-13
	No:	Claims	none
Inventive step (IS)	Yes:	Claims	1-12
	No:	Claims	13
Industrial applicability (IA)	Yes:	Claims	1-13
	No:	Claims	none

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Re Item I

Basis of the report

Claims 1, 9 and 11 are based on the corresponding **original claims 1 and 3,** resp. **claims 3 and 11**, resp. **claims 3 and 13,** and the description on original page 4, lines 19-24 and original page 5, line 24 and on fig. 2.

Claim 13 is based on the corresponding **original claims 1 and 8** and the description page 8, lines 4-8.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following document:
   D1: EP-A-0 399 611 (PHILIPS EL. UK LTD; PHILIPS NV (NL)) 28 Nov.1990

2. **Article 33(3) PCT**

   a) The subject-matter of **claims 1, 9 and 11** of the present application is novel and involves an inventive step (Article 33(2) and (3) PCT) for the following reasons:

   The subject-matter of **claims 1, 9 and 11** essentially differs from the prior art of D1 in that:

   (i) each handset receives and transmits data packets via receive and transmit data packet time slots only once during each epoch, during the receive and transmit data row pair for each handset, and
   (ii) if the handset is communicating with the base unit, said each handset receives and transmits audio packets during respective transmit and receive audio packet time slots of each row pair of the epoch

   b) The problem to be solved by the present invention may therefore be regarded as how to improve the data transmission to handsets in a multi-line wireless telephone system.

   c) The application describes a wireless telephone system which has a plurality of

handsets and a base unit. The main advantage of the solution proposed in **claims 1, 9 and 11** is that, although only a subset of all handsets may be able to communicate with the base unit via an audio channel at a given time, each handset has a pair of data packet time slots reserved for it to exchange data with the base unit within the TDMA epoch.

d) D1 refers to a communications system for data transmission over a time division duplex frequency channel. For fast data transmission additional duplex voice channels are made available quickly by a map store in each data secondary station that lists the usage and quality of all radio channels. No indication regarding the feature (i) is given.

Further no indication regarding the feature (i) is given in document D2: US-A-5 521 925, referring to a "method and apparatus for providing mixed voice and data communication in a TDMA access radio communications system" and D3: DE 31 30 176 A, referring to a "Verfahren zur dynamischen Zeitschlitzvergabe des Organisationskanals zellularer Mobilfunknetze in Abhängigkeit vom Verkehrsaufkommen".

e) Claims 2-8, 10 and 12 are dependent on **claims 1, 9 and 11**, resp., and as such also meet the requirements of the PCT with respect to novelty and inventive step.

3. **a)** The document D1 is regarded as being the closest prior art to the subject-matter of **claim 13**, and discloses (see abstract, figs. 1 and 2 , the description at column 3, lines 50-53, column 4, lines 32-41 and column 5, lines 6-11)

a wireless telephone system (fig. 1), comprising:
(a) a base unit having a base transceiver (fig. 1, PS1-PS4, fig. 3); and
(b) a plurality of wireless handset (fig. 1, SS1-SS6), each handset comprising a handset transceiver (fig. 3), for establishing a data link (fig. 2, (20), the 8 bytes of signalling data is regarded as a logical data link) and an audio link (fig. 2, (22), 40 bytes of digitised speech data) with the base unit via the base transceiver, wherein the data link is for transmitting signalling information (fig. 2, (20); i.e. a logical data link with 8 bytes of signalling data)

and the audio link is for transmitting voice data (fig. 2, (22), 40 bytes of digitised speech data) for a real-time telephone call, wherein the base unit, [...] if the handset is not currently using the audio link to transmit real-time telephone conference voice data (see column 2, lines 49-54) and transmits the stored information to the handset via the data link (column 5, lines 7-11, via the signalling portion) otherwise

all the features of **claim 13** except for the feature that:

(i) the base unit upon request from a handset for non-voice data from a data source retrieves the requested data from the data source and transmits the data via the audio link

b) Feature (i), however, is known from base units of state-of-the-art digital cordless phone systems with integrated voice mail (answering machine functionality).

Since digital cordless phone systems with integrated voice mail are in common use, the skilled person would regard it a normal design procedure to combine all the features set out in **claim 13**.

c) Thus, the subject-matter of **claim 13** does not involve an inventive step and does not satisfy the criterion set forth in Article 33(3) PCT.

Re Item VII

Certain defects in the international application

1. **Rule 6 PCT**

a) The independent **claims 1, 9, 11 and 13** are not in the two-part form in accordance with Rule 6.3(b) PCT, with those features known in combination from the prior art (document D1) being placed in a preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in a characterising part (Rule 6.3(b)(ii) PCT).

Nor has the applicant ensured that it is clear from the description which features of the subject-matter of the independent claims are known from document D1 (see

the PCT Guidelines PCT/GL/III, 2.3 a).

branch exchange (PBX) features and capabilities, in a multi-line wireless telephone system. It is also desirable to transmit or retrieve non-audio data over the RF channel. For example, a handset may wish to retrieve certain stored data, such as voice mail or caller ID data, which is stored in the base unit or in a device coupled to the base unit.

European Patent Application No. 0 399 611, filed 22.05.90, describes a communications system for data transmission over a time division duplex frequency channel, in which TDMA is used for forward and reverse transmissions between a primary and secondary station.

SUMMARY

A wireless telephone system comprising a base unit and a plurality of wireless handsets. The base unit has a base transceiver and a memory for storing stored information. Each handset has a handset transceiver for establishing a data link and an audio link over a shared RF channel with the base unit via the base transceiver, wherein the data link is for transmitting signaling information and the audio link is for transmitting voice data for a real-time telephone conference. The handset requests from the base unit certain stored information. In response, the base unit retrieves the requested stored information from the memory and transmits the stored information to the handset via the audio link.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of TDMA multi-line wireless telephone system, in accordance with an embodiment of the present invention; and

Fig. 2 is a schematic representation of the TDMA slot structure used in the TDMA scheme of the system of Fig. 1, in accordance with an embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to Fig. 1, there is shown a block diagram of TDMA multi-line wireless telephone system 100, in accordance with an embodiment of the present invention. TDMA system 100 comprises a base unit 110, which has receiver and transmitter units 112 and 111, respectively, and is coupled to external telephone network 116 via telephone line(s) 115. Base unit 110 has a memory or storage device 118, such as a RAM or hard disk drive, for storing stored data. System 100 also comprises N wireless handsets 120_1, 120_2, . . . 120_N. Each has a transmitter and receiver unit (transceiver), such as transmitter 121 and receiver 122 of handset 120_1. At any given time, some number (or none) of the handsets are operating or off hook (i.e., in the process of conducting a telephone call). System 100 thus provides a wireless network between the base station 110 and each handset 120_i ($1 \leq i \leq N$). In one embodiment, system 100 comprises 4 handsets 120_1–120_4, all of which may be active simultaneously. In another embodiment, system 100 comprises a different number of handsets, e.g. N=12, of which up to 8 can be active or operational at a time.

In one embodiment, the present invention comprises a TDMA system for connecting multiple transceivers to a base station over a single RF channel. In particular, system 100 employs a digital TDMA scheme, as described in further detail below, which allows power to be efficiently used since each operating handset is "off" (i.e., not transmitting or receiving data, and thus not using as much battery power) during most portions of the TDMA epoch, and is only "on" during its own time slices or slots. In another embodiment, a handset

powers off by switching off power to at least its CPU and transceiver (receiver and transmitter) units, while leaving powered on only a clock and associated timer or watchdog circuitry sufficient to wake up the CPU at a predetermined slot time.

Referring now to Fig. 2, there is shown a schematic representation of the TDMA slot structure 200 used in the TDMA scheme 200 of the system of Fig. 1, in accordance with an embodiment of the present invention. System 100 employs a TDMA epoch having structure 200, which is illustrated assuming 12 total handsets 120_1–120_{12}, of which 8 can be active or operational at a time, e.g. handsets 120_1–120_8. TDMA epoch structure 200 comprises a number of rows and columns. Each row of TDMA structure 200 represents a 2ms field of digital data, and is either even or odd and grouped in a pair with an odd or even, respectively, row or field. TDMA epoch structure 200 is a 48ms epoch.

In normal mode of operation, each field comprises nine total packets: a (non-audio) data packet in the first column (either transmitted from the base or from a handset) and eight audio packets, grouped in 4 pairs of two. Each such pair of audio packets in a row includes one packet (time slot) of base audio transmission (to a given handset from base unit 110) and one packet of handset audio transmission (from the given handset to the base). Thus, within each epoch, there is allocated to each handset one pair of data packet slots and several pairs of audio packet slots. The data packet slots are used to establish a "data link" with each respective handset, and the audio packet slots are used to establish an "audio link" with each respective handset. The data links together constitute the system's data channel, while the audio links constitute the system's audio

Thus, for example, row pair 0 comprises an even row and odd row. In the even row, the base transmits data in the first time slot (slot 251), to one of the 12 handsets, e.g. handset 120_1. There is one row pair in epoch 200 for each handset, so that each handset can receive and transmit data to base unit 110 once per epoch. After the first data slot 251, assuming handset 120_1 is operational (off hook), an audio packet is transmitted to handset 120_1 in audio packet slot 253, then an audio packet is transmitted by handset 120_1 to base unit 110 in audio packet slot 254, and so on for 3 of the other handsets until the end of the field or row. In the odd row for row pair 0, data slot 252 is used to receive data transmitted from handset 120_1 to base unit 110, and audio packets are transmitted for the remaining 4 active handsets. In row pairs 1–11, the same sequence occurs, except the data packets are to and from different handsets than for row pair 0.

It is desirable for a handset user to be able to retrieve stored data which is stored in memory 118 of the base unit 110. This information is in addition to signaling data typically transmitted via the data link and voice data typically transmitted via the audio link. Stored data includes all stored/backed up information that is available in the base unit. This information may represent voice, data, or other service information. For example, the stored data may be a voice mail information, caller ID information, or other service information.

Such stored information is typically requested by a handset via its data link, since the request is itself a type of signaling information. Because the stored data is not audio data pertaining to a concurrent telephone call, it could be transmitted via the data link. However,

this may be impractical or undesirable because the bandwidth of the data link is lower than that of the audio link. Therefore, in the present invention, when stored information is requested by a handset, the audio link is temporarily converted to a "stored data" link, voice data transmission is temporarily halted (muted or interrupted), and stored data is transferred to the handset during that handset's audio data slots. This allows the stored data to be transmitted at a much higher rate to the handset than if the lower-bandwidth data link were used.

In the present invention, first, a handset 120_i requests stored data from base unit 110. Base unit 110 then fetches the stored data from memory 118, and combines the stored data into the voice link for handset 120_i as digital information. Since handset 120_i has knowledge about its request, it knows what type of stored data to expect on its audio link, and thus knows which type of decoding or processing to use when the stored information is received.

For example, if a voice mail message is to be retrieved, handset 120_i transmits an appropriate request for the voice mail message to base unit 110 via its data link. Base unit 110 retrieves the stored voice mail data, which may be stored in compressed format for efficient use of memory 118. This compressed, digital information representing the requested voice mail message is then transmitted to handset 120_i via its audio link, instead of its data link. Handset 120_i then processes the stored data received via its audio link through its voice decompression engine. On the other hand, if caller ID information is retrieved, then the data coming over the audio link is appropriately processed and displayed on the handset's display.

The present invention, therefore, creates an asymmetrical link for information retrieval in a wireless system so that efficient use of the available bandwidth is possible.

In an alternative embodiment, the audio link is used to retrieve stored data only if it is not already in use. In this case, the data link is used by a handset to request retrieval of stored data. If the audio link is in use by the handset, then the data link is used to transmit the stored data to the handset. However, if the audio link is not in use, then the audio link is used instead as a "stored data" link to transmit the stored data at a higher rate.

In an alternative embodiment, the stored information retrieved by a handset is not actually stored in base unit 110, but is stored in a device external to base unit 110, such as an external PC or storage device, which is coupled by a suitable interface to base unit 110. In this case, the stored information is retrieved by the handset from the storage device, via base unit 110, and the storage device is considered to be the same as memory 118, whether located in base unit 110, directly accessible by base unit 110, or accessible by base unit 110 via some interface. For purposes of this application, therefore, any information stored either directly in base unit 110 or in a device functionally coupled thereto such that the base unit is able to provide the stored data upon request to a handset, is considered to be information stored in base unit 110, since from the point of view of a handset, the request is made of base unit 110 and the information provided by base unit 110 appears to be stored in base unit 110.

One skilled in the art will recognize that the wireless system described above according to the principles of the invention may be a

cellular system where base unit 110 represents a base station serving one of the cells in a cellular telephone network.

In an alternative embodiment, instead of a handset retrieving over the audio link data actually stored in memory 118, the handset may wish to retrieve data from a data source accessible to the base unit 110. For example, base unit 110 may receive via an external line a modem signal containing data. In this case, the handset may be coupled to a telephone data port of a computer, for example. The handset requests from base unit 110 to be connected to a data source or channel, such as that provided by the modem. Base unit 110 then transmits the data decoded from the modem, to the handset via the audio link.

CLAIMS

1. A wireless telephone system (100), comprising:

(a) a base unit (110) having a base transceiver (111, 112); and

(b) a plurality of wireless handsets (120), each handset (120_i) comprising a handset transceiver (121, 122) for establishing with the base unit (110) via the base transceiver a time-division multiple access (TDMA) data link and a TDMA audio link, in accordance with a TDMA epoch (200) allocating exclusive data and audio packet time slots to each handset (120_i), wherein the data link is for transmitting signaling information and the audio link is for transmitting voice data for a real-time telephone call, wherein the base unit (110), upon request from a handset (120_i) for data from a data source, retrieves the requested data from the data source and transmits the retrieved data to the handset (120_i) via the audio link, wherein:

the epoch (200) has a plurality of transmit and receive data row pairs, one such row pair for each handset (120_i), wherein each row of a row pair comprises an even row comprising a transmit data time slot for the respective handset and a plurality of transmit and receive audio packet time slots for half of the maximum number of the plurality of handsets which may be communicating at a time, and an odd row comprising a receive data time slot for the respective handset and a plurality of transmit and receive audio packet time slots for the other half of the maximum number of the plurality of handsets which may be communicating at a time; and

each handset (120_i) receives and transmits data packets via receive and transmit data packet slots (251, 252) only once during each epoch (200), during the transmit and receive data row pair for each said handset, and, if the handset is communicating with the base unit, said each handset receives and transmits audio packets during respective transmit and receive audio packet time slots (253, 254) of each row pair of the epoch.

2. The system of claim 1, wherein:

the plurality of handsets (120) comprises 12 handsets, 8 of which may be communicating at a time;

the epoch (200) comprises 12 data row pairs, one data row pair for each handset; and each row pair comprises 8 transmit and receive audio packet time slot pairs for audio communications for the communicating handsets.

3. The system of claim 1, wherein the data source is a memory (118) for storing data and the requested data is stored data stored in the memory.

4. The system of claim 3, wherein the base unit (110) comprises the memory (118).

5. The system of claim 3, wherein the base unit (110) is coupled to an external computer comprising the memory (118).

6. The system of claim 3, wherein the base unit (110) transmits the stored information to the handset (120$_i$) via the audio link only if the handset is not currently using the audio link to transmit real-time telephone conference voice data, and transmits the stored information to the handset via the data link if the handset is currently using the audio link to transmit real-time telephone conference voice data.

7. The system of claim 3, wherein the stored information is one of stored caller ID information and stored compressed voice mail message data.

8. The system of claim 7, wherein the handset requesting the stored information processes the stored information upon receipt in accordance with the nature of the stored information.

9. In a wireless telephone system (100) comprising a base unit (110) having a base transceiver (111, 112) and a plurality of wireless handsets (120), each handset (120$_i$) comprising a handset transceiver (121, 122), a method comprising the steps of:

(a) establishing, with each handset via its handset transceiver, a time-division multiple access (TDMA) data link with the base unit via the base transceiver, and, with each handset that is communicating with the base unit, a TDMA audio link with the base unit via

the base transceiver, in accordance with a TDMA epoch (200) allocating exclusive data and audio packet time slots to each handset (120_i), wherein the data link is for transmitting signaling information and the audio link is for transmitting voice data for a real-time telephone call;

(b) requesting, with the handset, from the base unit, data from a data source;

(c) retrieving, with the base unit, the requested data from the data source in response to the request; and

(d) transmitting the retrieved data from the base unit to the handset via the audio link, wherein:

the epoch (200) has a plurality of transmit and receive data row pairs, one such row pair for each handset (120_i), wherein each row of a row pair comprises an even row comprising a transmit data time slot for the respective handset and a plurality of transmit and receive audio packet time slots for half of the maximum number of the plurality of handsets which may be communicating at a time, and an odd row comprising a receive data time slot for the respective handset and a plurality of transmit and receive audio packet time slots for the other half of the maximum number of the plurality of handsets which may be communicating at a time; and

each handset (120_i) receives and transmits data packets via receive and transmit data packet slots (251, 252) only once during each epoch (200), during the transmit and receive data row pair for each said handset, and, if the handset is communicating with the base unit, said each handset receives and transmits audio packets during respective transmit and receive audio packet time slots (253, 254) of each row pair of the epoch.

10. The method of claim 9, wherein the data source is a memory for storing data and the requested data is stored data stored in the memory.

11. A base unit (110) for communicating with a plurality of wireless handsets (120), each handset (120_i) comprising a handset transceiver (121, 122), the base unit (110) comprising:

(a) a base transceiver (111, 112) for establishing a time-division multiple access (TDMA) data link with each handset via the base transceiver, and, with each handset that is

communicating with the base unit, a TDMA audio link via the base transceiver, in accordance with a TDMA epoch (200) allocating exclusive data and audio packet time slots to each handset (120_i), wherein the data link is for transmitting signaling information and the audio link is for transmitting voice data for a telephone call; and

(b) a memory (118) for storing stored information, wherein the base unit, upon request from the handset for stored information stored in the memory, retrieves the requested stored information from the memory and transmits the stored information to the handset via the audio link, wherein:

the epoch (200) has a plurality of transmit and receive data row pairs, one such row pair for each handset (120_i), wherein each row of a row pair comprises an even row comprising a transmit data time slot for the respective handset and a plurality of transmit and receive audio packet time slots for half of the maximum number of the plurality of handsets which may be communicating at a time, and an odd row comprising a receive data time slot for the respective handset and a plurality of transmit and receive audio packet time slots for the other half of the maximum number of the plurality of handsets which may be communicating at a time; and

each handset (120_i) receives and transmits data packets via receive and transmit data packet slots (251, 252) only once during each epoch (200), during the transmit and receive data row pair for each said handset, and, if the handset is communicating with the base unit, said each handset receives and transmits audio packets during respective transmit and receive audio packet time slots (253, 254) of each row pair of the epoch.

12. The base unit of claim 11, wherein the data source is a memory for storing data and the requested data is stored data stored in the memory.

13. A wireless telephone system (100), comprising:

(a) a base unit (110) having a base transceiver (111, 112); and

(b) a plurality of wireless handsets (120), each handset (120_i) comprising a handset transceiver (121, 122) for establishing a data link and an audio link with the base unit (110) via the base transceiver, wherein the data link is for transmitting signaling

information and the audio link is for transmitting voice data for a real-time telephone call, wherein the base unit (110), upon request from a handset (120_i) for non-voice data from a data source, retrieves the requested data from the data source and transmits the retrieved data to the handset (120_j) via the audio link if the handset is not currently using the audio link to transmit real-time telephone conference voice data and transmits the stored information to the handset via the data link otherwise.